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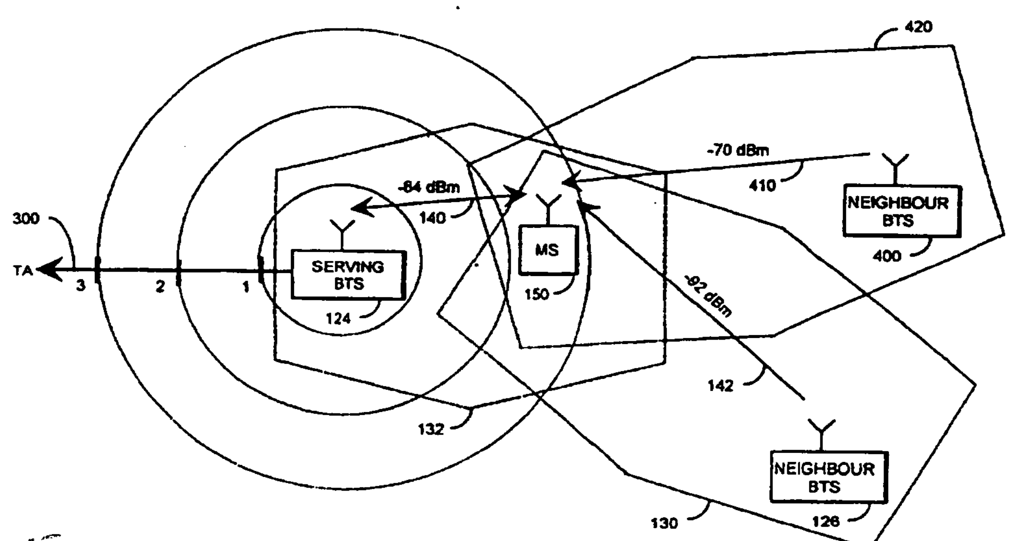

(57) Abstract

The invention relates to a method of locating a mobile station and a cellular radio network. The method comprises the following steps: the information received and measured by a mobile station (150) is transmitted to a network management system (100), the information received and measured by the mobile station (150) is compared with the field strength information in a field strength matrix (220), the location of the mobile station (150) is estimated as coordinates of the field strength matrix (220) in relation to the base station (124) of the serving cell (132) and the base station (126) of at least one neighbouring cell (130) in such a manner that the information (140, 142) received and measured by the mobile station (150) corresponds to the field strength information in the field strength matrix (220) as accurately as possible. The invention also discloses necessary modifications to the system applying the method.

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A METHOD OF LOCATING A MOBILE STATION

FIELD OF THE INVENTION

The invention relates to a method of locating a mobile station in a cellular radio network comprising at least one network management system, at least one network system, at least one base station system and at least one mobile station, said network management system comprising a field strength matrix, which comprises information on coordinates and field strength for a serving cell and at least one neighbouring cell, said base station system comprising at least two base stations and at least one base station controller, and the base station has a coverage area, i.e. a cell, and the mobile station has a bidirectional radio link with the base station of the serving cell and a receiving connection with at least one base station of the neighbouring cell, and the mobile station receives information on its bidirectional radio link from the base station of the serving cell, and the mobile station measures information on its bidirectional radio link with the base station of the serving cell, and the mobile station also measures information on its receiving connection with at least one base station of the neighbouring cell.

BACKGROUND OF THE INVENTION

The cellular radio networks of the prior art do not allow the location of a mobile station to be determined very accurately. Figure 3 illustrates a method by means of which the location of a mobile station can be determined roughly as distance from a base station. The base station 124 has a bidirectional radio link 140 with the mobile station 150. The base station 124 has information on the timing advance value TA 300 of the radio link 140 in question; this value is used to compensate the radio wave propagation delay resulting from the distance between the mobile station 150 and the base station 124. The base station 124 reports the TA 300 calculated by it to the mobile station 150 so as to allow the mobile station 150 to delay its transmission moment according to the TA 300. Value 1 of the TA 300 corresponds approximately to a distance of 550 metres from the base station 124, value 2 of the TA 300 approximately to a distance of 1100 metres, value 3 of the TA 300 approximately to a distance of 1650 metres, etc. In principle the distance from the base station is the value of the TA 300 multiplied by 550 metres. Due to multipath propagation the calculated distance may deviate from the real distance by 550 to 1100 metres, in some cases

even more. On the other hand, if the base station 124 has an omnidirectional antenna, the only thing that can be said of the location of the mobile station 150 by using this method is that the mobile station is in principle in the area 310, which is within a certain distance from the base station 124. In practice even the size of the area may be larger than the area 310 with a diameter of 550 metres illustrated in the figure. If the coverage area of the base station 124 is divided into three sectors, it is possible to determine a slightly smaller area within which the mobile station 150 is located. In the figure, for example, this would be one third of the area 310, i.e. a band of 120 degrees. In fact, the method described above is not very useful, if it is necessary to locate the mobile station 150 so as to find it.

Another solution of the prior art is to connect the mobile station with a GPS receiver, by means of which the location can be determined extremely accurately. The greatest disadvantage of this method is that the parts of the GPS receiver increase the production costs as well as the size and weight of a mobile station.

BRIEF DESCRIPTION OF THE INVENTION

The object of the present invention is to provide a method of locating a mobile station by means of which the drawbacks of the prior art can be obviated.

This is achieved with the method set forth in the introduction. The method is characterized in that it comprises the following steps:

A) the information received and measured by a mobile station is transmitted to a network management system,

B) the information received and measured by the mobile station is compared with the field strength information in a field strength matrix,

C) the location of the mobile station is estimated as coordinates of the field strength matrix in relation to the base station of the serving cell and the base station of at least one neighbouring cell in such a manner that the information received and measured by the mobile station corresponds to the field strength information in the field strength matrix as accurately as possible

The invention also relates to a method of locating a mobile station in a cellular radio network comprising at least one network management system, at least one network system, at least one base station system and at least one mobile station, said network management system comprising a field strength matrix, which comprises information on coordinates and field strength

for a serving cell and at least one neighbouring cell, said base station system comprising at least two base stations and at least one base station controller, and the base station has a coverage area, i.e. a cell, and the mobile station has a bidirectional radio link with the base station of the serving cell and a receiving connection with at least one base station of the neighbouring cell, and the mobile station receives information on its bidirectional radio link from the base station of the serving cell, and the mobile station measures information on its bidirectional radio link with the base station of the serving cell, and the mobile station also measures information on its receiving connection with at least one base station of the neighbouring cell.

The system of the invention is characterized in that the network management system is arranged to receive information received and measured by the mobile station and, by utilizing this information, to estimate the location of the mobile station as coordinates of the field strength matrix.

The method of the invention has significant advantages. A major advantage is that the location of a mobile station can be determined so accurately that it can be found e.g. when the user is in an emergency. It is also useful that the invention allows the route of a mobile station to be followed. Another significant advantage is that no great changes are required to the structure of the mobile station, hence its production costs will not increase, and neither will its size nor weight. A further great advantage is that the method can be used for detecting traffic hot spots, i.e. congested areas, in the network, whereby the network can be designed to be more reliable in those areas. The advantages of the system of the invention are the same as those described above in connection with the method. Preferred embodiments of the invention as well as other more detailed embodiments highlight the advantages of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be described in a greater detail by means of examples with reference to the accompanying drawings, in which

Figure 1 shows a cellular radio network according to the invention,

Figure 2 shows the essential parts of the structure of a network management system,

Figure 3 shows the method of the prior art described above and its disadvantages,

Figure 4 shows realization of the method according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 shows a typical cellular radio network. It comprises at least one network management system 100, at least one network system 110, at least one base station system 120 and at least one mobile station 150.

The network management system 100 is utilized for using, controlling and maintaining different functions of the cellular radio network. The network operator receives information on the quality of functions and services provided through the network management system 100. The network operator adjusts different parameters of the mobile telephone system by means of the network management system 100, thus controlling its operation. The network management system 100 comprises a field strength matrix, which in turn comprises information on coordinates and field strength for the serving cell 132 and for at least one neighbouring cell 130. A digital map is a map digitized according to the prior art and is known in connection with the planning and prediction tool (not shown) and is used at the planning and introduction stage of a radio network for planning how to construct a radio network so that it will cover all the desired areas. It can also be used for predicting which areas will probably be problematic with respect to coverage. The propagation model of radio waves is also tuned and adjusted according to measurements conducted in the terrain, whereby it is possible to obtain both measured and predicted information on the field strength for each cell.

The main function of the network management system 110 is call control; therefore it comprises a mobile switching centre (not shown).

The base station system 120 comprises at least two base stations 124, 126 and at least one base station controller 122. The base station system 120 is responsible for controlling the radio path. The base station 124, 126 has a coverage area, i.e. a cell 130, 132.

The mobile station has a bidirectional radio link 140 with the base station 124 of the serving cell 132 and a receiving connection 142 with at least one base station 126 of the neighbouring cell 130. The mobile station 150 receives information on its bidirectional radio link 140 from the base station 124 of the serving cell 132. The mobile station 150 measures information 140 on its bidirectional radio link 140 with the base station 124 of the serving cell 132. The mobile station 150 also measures information on its receiving connection 142 with at least one base station 126 of the neighbouring cell 130. In all figures the connection 140, 142, 410 also represents the information on

the connection received by the mobile station 150 and the field strength measurements carried out by it.

At a general level, the method of locating a mobile station comprises the following steps:

A) the information received and measured by the mobile station 150 is transmitted to the network management system 100,

B) the information received and measured by the mobile station 150 is compared with the field strength information in the field strength matrix 220,

C) the location of the mobile station 150 is estimated as coordinates of the field strength matrix 220 in relation to the base station 124 of the serving cell 132 and the base station 126 of at least one neighbouring cell 130 in such a manner that the information 140, 142 received and measured by the mobile station 150 corresponds to the field strength information in the field strength matrix 220 as accurately as possible.

Figure 4 shows, in a simplified manner, the parts that are essential in the application of the method to the GSM/DCS system. The figure illustrates the base station 124 of the serving cell 132 and two base stations 126, 400 of neighbouring cells. The mobile station 150 has a bidirectional radio link 140 with the base station 124 of the serving cell 132. The mobile station 150 receives the timing advance value TA 300 from the base station 124 of the serving cell 132. The figure shows distance zones corresponding to different values of the TA 300 (1, 2, 3) from the base station 124 of the serving cell 132. In this example the TA 300 is given the value 3. The mobile station 150 measures the field strength 140 for the base station 124 of the serving cell; the field strength 140 receives the value -84 dBm. Furthermore, the mobile station 150 has two receiving connections 142, 410 with the base stations 126, 400 of the neighbouring cells 130, 420. The mobile station 150 measures the field strengths 142, 410 of the receiving connections, whereby the field strength 142 of the base station 126 in neighbouring cell 130 receives the value -92 dBm and the field strength 410 of the base station 400 in neighbouring cell 420 receives the value -70 dBm. The location method comprises the following steps:

A) the timing advance value 300 received by the mobile station 150, the field strength 140 of the serving cell 132, measured by the mobile station 150, and the field strength 142 of at least one neighbouring cell 130, measured by the mobile station 150 (and in this example the field strength 410

of another neighbouring cell 420), with their identification data are transmitted to the network management system 100,

B) the location of the mobile station 150 in the area of the serving cell is estimated on the basis of the timing advance value 300,

C) the estimate of the location of the mobile station 150 is specified more accurately by comparing the field strength 140 of the serving cell 132, measured by the mobile station 150, with the field strength information on the serving cell 132 in question, represented in the field strength matrix 220,

D) the estimate of the location of the mobile station 150 is specified more accurately by comparing the field strength 142 of the serving cell 130 measured by the mobile station 150 with the field strength information on the serving cell in question, represented in the field strength matrix 220,

E) step D is repeated until a sufficient number of measuring results have been processed, i.e. in this example the estimate of the location of the mobile station 150 is specified more accurately by comparing the field strength 410 of the other neighbouring cell 420, measured by the mobile station 150, with the field strength information on the other neighbouring cell 420 in question, represented in the field strength matrix 220,

F) the location of the mobile station 150 is represented as coordinates of the field strength matrix 220.

In the above example measurement data were available on the base stations of two neighbouring cells. Even though measurement data were available only on one neighbouring cell, this would still yield better results than the use of the TA of the serving cell only. In the most preferred embodiment of the invention in the GSM/DCS system, measurement data are available on six neighbouring cells that are received best. In principle, the mobile station could measure the radio field strength of all those base stations that are included in its list of neighbouring cells. The maximum number of base stations included in the list is 32. This would, however, require modification of the specifications of the GSM/DCS system.

The route of the mobile station 150 is determined on the basis of at least two locations of the mobile station 150. The route of the mobile station 150 is compared with roads, streets or other possible traffic routes shown on a digital map, and then the route of the mobile station 150 is corrected so that it corresponds to the traffic route used. The comparison of routes is carried out e.g. by employing a pattern recognition method.

According to one preferred embodiment of the invention, the method is used for detecting traffic hot spots in the cellular radio network by calculating the distribution of the locations of mobile stations 150 in the cells 130, 132.

Due to reasons related to information security, the system of the method can be set to a state in which the location of only a mobile station 150 making an emergency call is indicated as coordinates of the field strength matrix 220.

The accuracy of the method can be improved in such a manner that the network management system 100 detects cells 130, 132 located indoors and any leaking cables as well as repeaters, whereby attenuation due to indoor cells and the use of leaking cables and repeaters are taken into account in the method.

The method is applied in the system illustrated in Figure 1. The network management system 100 is arranged to receive information received and measured by the mobile station 150 and, by using this information, to estimate the location of the mobile station 150 as coordinates of the field strength matrix 220. It is obvious to one skilled in the art that the arrangement can be carried out in several different ways. Figure 2 shows one preferred embodiment. The network management system 100 comprises means 200 for receiving the timing advance value 300 received by the mobile station 150, the field strength 140 of the serving cell 132, measured by the mobile station 150, the field strength 142 of at least one neighbouring cell 130, measured by the mobile station 150, and their identification data, means 210 for estimating the location of the mobile station 150 on the basis of the timing advance value 300, means 210 for comparing the field strength 140 of the serving cell 132 measured by the mobile station 150 with the field strength information on the serving cell 132, represented in the field strength matrix 220, means 210 for comparing the field strength 142 of the neighbouring cell 130, measured by the mobile station 150, with the field strength information represented in the field strength matrix 220 on the neighbouring cell 130, and means 230 for representing the location of the mobile station 150 as coordinates of the field strength matrix 220.

With respect to the invention it is not relevant which part of the network management system 100 is arranged to receive the information required by the method and to carry out its processing. Any part of the network

management system 100 can be arranged to carry out the functions according to the method. The method can also be carried out in such parts of the network management system 100 that are not included in this description for the sake of clarity. Furthermore, if the network management system 100 consists of several different parts, the functions of the parts of the present system carrying out the method can be distributed among these different parts of the network management system 100.

On the basis of the information (digital map) contained in the planning and prediction tool mentioned above, it is possible to draw up a field strength matrix according to the method, the matrix including information on coordinates and field strength. The field strength information may be measured and/or predicted. If the location or route of a mobile station is to be represented as coordinates of the field strength matrix, coordinates are expressed as numerical values or illustrated on a map, provided that the system comprises a digital map.

When the method is used for tracing the route of a mobile station, the network management system 100 also comprises means 210 for determining the route of the mobile station 150 on the basis of at least two locations of the mobile station 150, means 210 for comparing the route of the mobile station 150 with roads, streets and other traffic routes on the digital map 220, means 210 for correcting the route of the mobile station 150 to correspond to the traffic route used, and means 230 for representing the route of the mobile station 150 as coordinates of the field strength matrix 220.

When the method is used for detecting traffic hot spots, the network management system 100 comprises means 210 for detecting traffic hot spots in the cellular radio network by calculating the distribution of the locations of mobile stations 150 in the cells 130, 132.

Due to reasons related to information protection, the network management system 100 comprises means 210, 230 for indicating the location of only a mobile station 150 making an emergency call as coordinates of the field strength matrix 220, and means 210, 230 for indicating the route of only a mobile station 150 making an emergency call as coordinates of the field strength matrix 220.

So as to improve the operation of the system the network management system 100 comprises means for detecting the cells 130, 132 located indoors and any leaking cables as well as repeaters.

The simplest way of implementing the invention is to arrange the network management system 100 to operate in a general purpose computer. which in addition to standard means and software is provided with telecommunications hardware, telecommunications software and database software. In this case, the steps of the method of the invention, carried out by the means described, can be modified so as to be performed as software. The software can be stored e.g. in a disk, hard disk or memory circuit. In that case the means 210 in Figure 2 are interpreted as telecommunications hardware and telecommunications software by means of which the software receives necessary information from mobile stations. The means 230 comprise a standard user interface to a computer, i.e. a keyboard, mouse, display and operating system. The means 220 comprise a hard disk and database software, in which the field strength matrix including information on coordinates, field strength and other matters as well as the software performing the method are stored. The means 210 are interpreted as the computer's central unit including necessary additional circuits, e.g. the RAM and ROM. A possible digital map included in the system can also be stored in the means 220.

On the other hand, the means required by the method of the invention can be realized in a device provided for this purpose, e.g. with general or signal processors or with discrete logic.

Although the invention has been described above by means of an example illustrated in the accompanying drawings, it will be obvious that the invention is not limited to it, but may be modified in several ways within the inventive concept disclosed in the appended claims.

CLAIMS

1. A method of locating a mobile station (150) in a cellular radio network comprising at least one network management system (100), at least one network system (110), at least one base station system (120) and at least one mobile station (150), said network management system (100) comprising a field strength matrix (220), which comprises information on coordinates and field strength for a serving cell (132) and for at least one neighbouring cell (130), said base station system (120) comprising at least two base stations (124, 126) and at least one base station controller (122), and the base station (124, 126) has a coverage area, i.e. a cell (130, 132), and the mobile station (150) has a bidirectional radio link (140) with the base station (124) of the serving cell (132) and a receiving connection (142) with at least one base station (126) of the neighbouring cell (130), and the mobile station (150) receives information on its bidirectional radio link (140) from the base station (124) of the serving cell (132), and the mobile station (150) measures information (140) on its bidirectional radio link (140) with the base station (124) of the serving cell (132), and the mobile station also measures information (142) on its receiving connection (142) with at least one base station (126) of the neighbouring cell (130), **characterized** in that the method comprises the following steps:

A) the information received and measured by the mobile station (150) is transmitted to the network management system (100),

B) the information received and measured by the mobile station (150) is compared with the field strength information in the field strength matrix (220),

C) the location of the mobile station (150) is estimated as coordinates of the field strength matrix (220) in relation to the base station (124) of the serving cell (132) and to the base station (126) of at least one neighbouring cell (130) in such a manner that the information (140, 142) received and measured by the mobile station (150) corresponds to the field strength information in the field strength matrix (220) as accurately as possible.

2. A method as claimed in claim 1, **characterized** in that in GSM/DCS systems the method comprises the following steps:

A) the timing advance value (300) received by the mobile station (150), the field strength (140) of the serving cell (132), measured by the mobile station (150), and the field strength (142) of at least one neighbouring cell (130), measured by the mobile station (150), and their identification data are transmitted to the network management system (100),

B) the location of the mobile station (150) in the area of the serving cell (132) is estimated on the basis of the timing advance value (300),

C) the estimate of the location of the mobile station (150) is specified more accurately by comparing the field strength (140) of the serving cell (132), measured by the mobile station (150), with the field strength information on the serving cell (132), represented in the field strength matrix (220),

D) the estimate of the location of the mobile station (150) is specified more accurately by comparing the field strength (142) of the neighbouring cell (130), measured by the mobile station (150), with the field strength information on the neighbouring cell (130), represented in the field strength matrix (220),

E) step D is repeated until a sufficient number of measurement results have been processed,

F) the location of the mobile station (150) is represented as coordinates of the field strength matrix (220).

3. A method as claimed in claim 1 or 2, **characterized** in that the route of the mobile station (150) is determined on the basis of at least two locations of the mobile station (150).

4. A method as claimed in claim 3, **characterized** in that the network management system (100) also comprises a digital map (220), and that the route of the mobile station (150) is compared with roads, streets and other traffic routes shown on the digital map (220), after which the route of the mobile station (150) is corrected to correspond to the traffic route used.

5. A method as claimed in claim 4, **characterized** in that the comparison is carried out by employing a pattern recognition method.

6. A method as claimed in claim 1 or 2, **characterized** in that the method is used for detecting traffic hot spots in the cellular radio network by calculating the distribution of the location of mobile stations (150) in the cells (130, 132).

7. A method as claimed in claim 1 or 2, **characterized** in that the location of only a mobile station (150) making an emergency call is indicated as coordinates of the field strength matrix (220).

8. A method as claimed in claim 1 or 2, **characterized** in that the cells (130, 132) located indoors and any leaking cables as well as repeaters are detected in the network management system (100), whereby attenuation caused by indoor cells and the use of leaking cables and repeaters are taken into account in the method.

9. A system for locating a mobile station (150) in a cellular radio network comprising at least one network management system (100), at least one network system (110), at least one base station system (120) and at least one mobile station (150), said network management system (100) comprising a field strength matrix (220), which comprises information on coordinates and field strength for a serving cell (132) and for at least one neighbouring cell (130), said base station system (120) comprising at least two base stations (124, 126) and at least one base station controller (122), the base station (124, 126) has a coverage area, i.e. a cell (130, 132), and the mobile station (150) has a bidirectional radio link (140) with the base station (124) of the serving cell (132) and a receiving connection (142) with at least one base station (126) of the neighbouring cell (130), and the mobile station (150) receives information on its bidirectional radio link (140) from the base station (124) of the serving cell (132), and the mobile station (150) measures information (140) on its bidirectional radio link (140) with the base station (124) of the serving cell (132), and the mobile station (150) also measures information (142) on its receiving connection (142) with at least one base station (126) of the neighbouring cell (130), **characterized** in that the network management system (100) is arranged to receive information (140, 142) received and measured by the mobile station (150) and, by utilizing this information (140, 142), to estimate the location of the mobile station (150) as coordinates of the field strength matrix (220).

10. A system as claimed in claim 9, **characterized** in that the network management system (100) comprises

means (200) for receiving the timing advance value (300) received by the mobile station (150), the field strength (140) of the serving cell (132), measured by the mobile station (150), the field strength (142) of at least one

neighbouring cell (130), measured by the mobile station (150), and their identification data,

means (210) for estimating the location of the mobile station (150) on the basis of the timing advance value (300),

means (210) for comparing the field strength (140) of the serving cell (132), measured by the mobile station (150), with the field strength information on the serving cell (132), represented in the field strength matrix (220),

means (210) for comparing the field strength (142) of the neighbouring cell (130), measured by the mobile station (150), with the field strength information on the neighbouring cell (130), represented in the field strength matrix,

means (230) for representing the location of the mobile station (150) as coordinates of the field strength matrix (220).

11. A system as claimed in claim 10, **characterized** in that the network management system (100) comprises

a digital map (220), and

means (210) for determining the route of the mobile station (150) on the basis of at least two locations of the mobile station (150),

means (210) for comparing the route of the mobile station (150) with roads, streets and other traffic routes shown on the digital map (220),

means (210) for correcting the route of the mobile station (150) to correspond to the traffic route used,

means (230) for representing the route of the mobile station (150) as coordinates of the field strength matrix (220).

12. A system as claimed in claim 10, **characterized** in that the network management system (100) comprises means (210) for detecting traffic hot spots in the cellular radio network by calculating the distribution of the locations of mobile stations (150) in the cells (130, 132).

13. A system as claimed in claim 10, **characterized** in that the network management system (100) comprises means (210, 230) for indicating the location of only a mobile station (150) making an emergency call as coordinates of the field strength matrix (220).

14. A system as claimed in claim 11, **characterized** in that the network management system (100) comprises means (210, 230) for

indicating the route of only a mobile station (150) making an emergency call as coordinates of the field strength matrix (220).

15. A system as claimed in claim 10, **characterized** in that the network management system (100) comprises means for detecting cells (130, 132) located indoors and any leaking cables as well as repeaters.

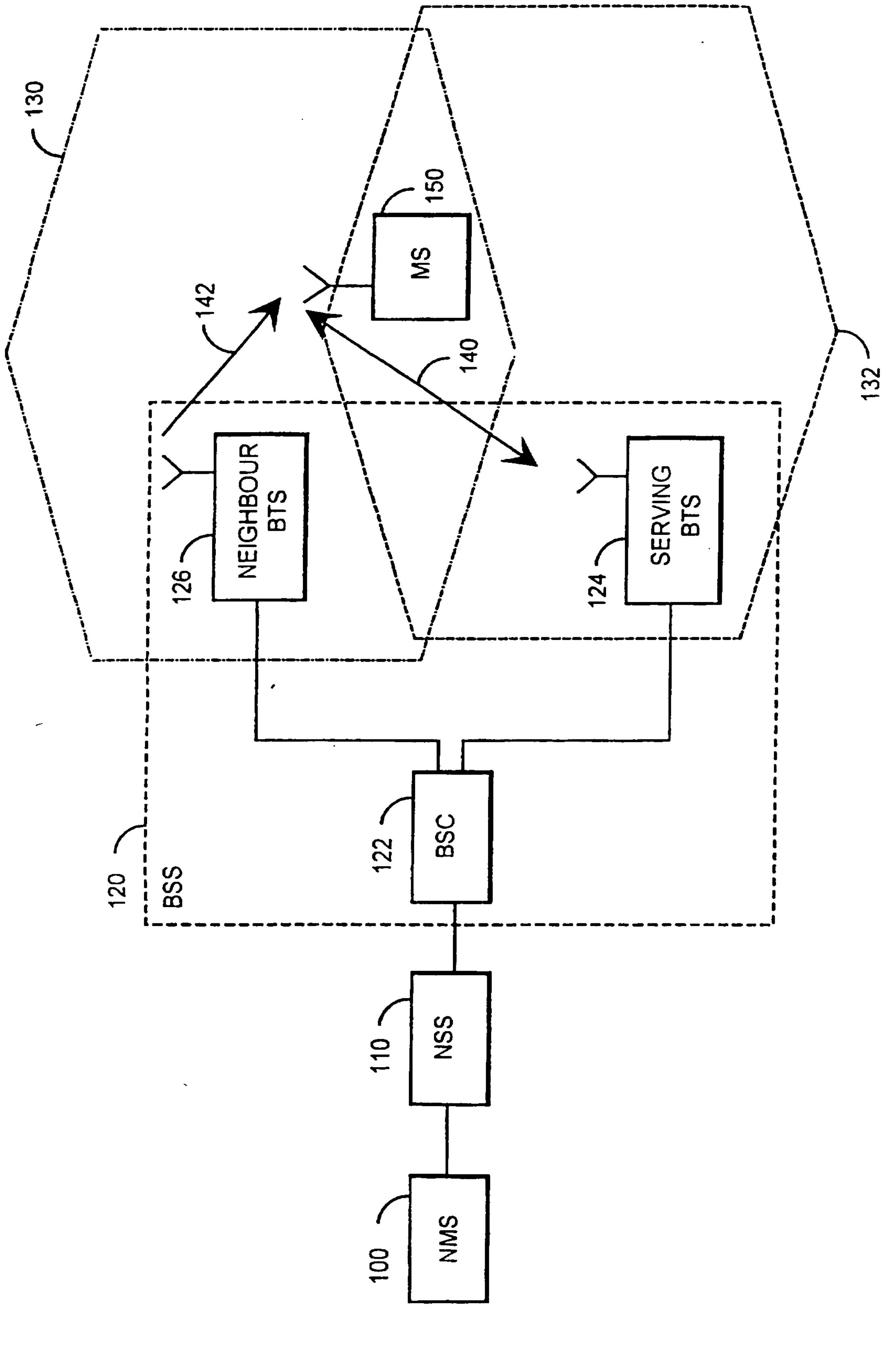
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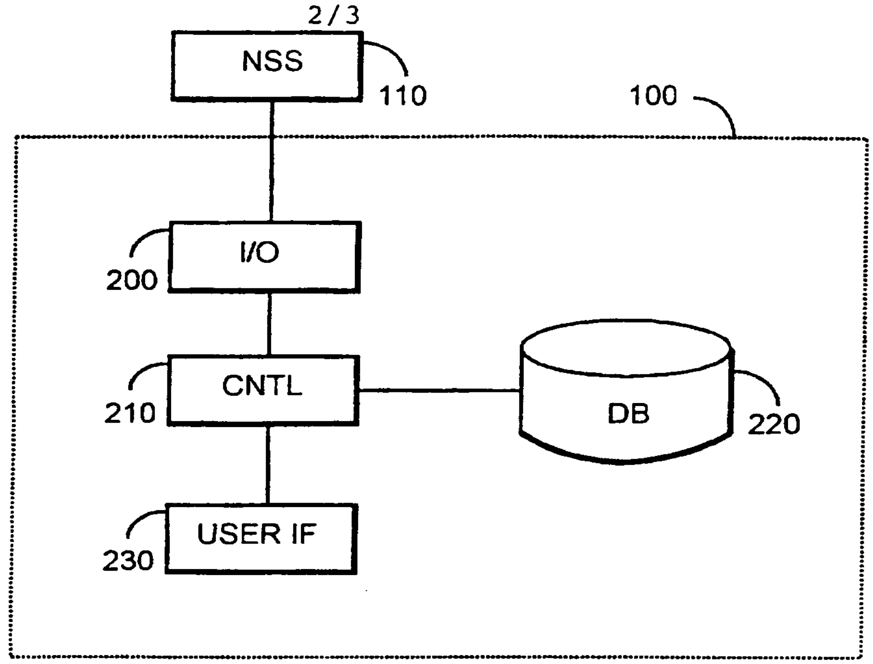
Fig. 1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220
USER IF
230

Fig. 2

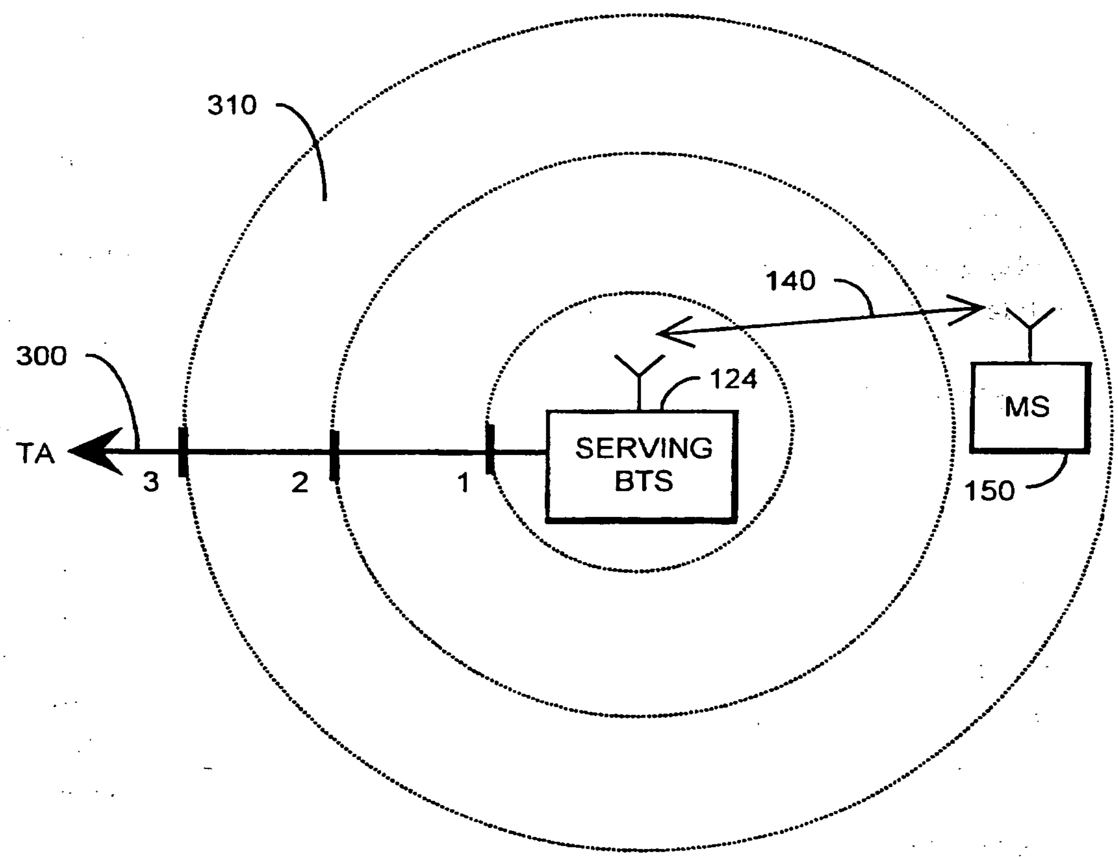
310
140
300
124
MS
TA
SERVING
BTS
3
2
1
150

Fig. 3

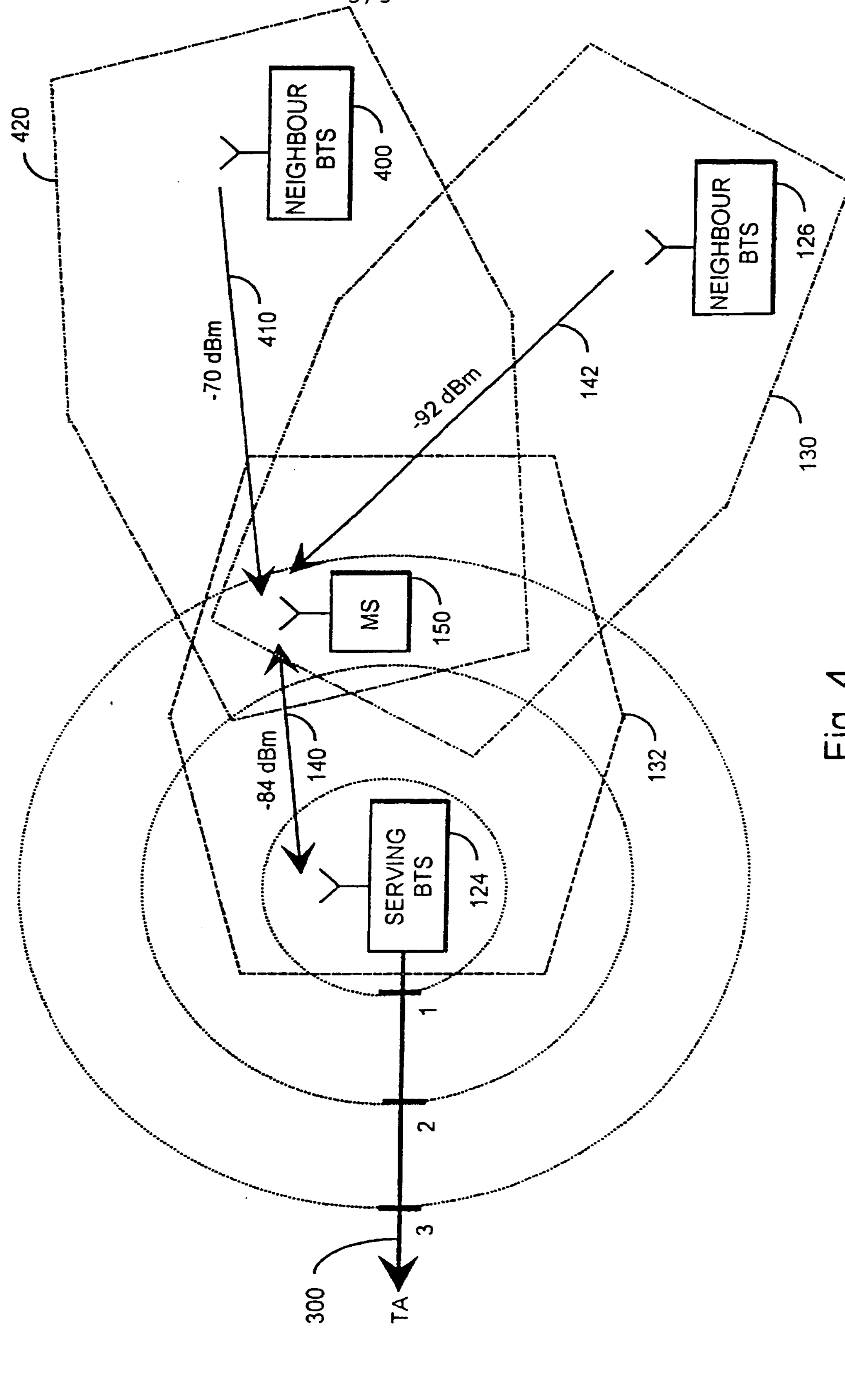
NEIGHBOUR BTS
400
420
-70 dBm
410
NEIGHBOUR BTS
126
-92 dBm
142
130
MS
150
-84 dBm
140
132
SERVING BTS
124
1
2
3
300
TA

Fig. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00596

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/38
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G01S, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CLAIMS, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0631453 A2 (TELIA AB), 28 December 1994 (28.12.94), column 2, line 13 - column 4, line 9	1,3,6,9,12
Y		2
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X	Patent Abstracts of Japan, Vol 14,No 205, E-921 abstract of JP 2-44929 A (NIPPON TELEGR & TELEPH CORP), 14 February 1990 (14.02.90)	1-3,9,10
Y		4,11
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" ertier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 March 1998	23-03-1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Bo Gustavsson Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 97/00596

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ITG-Fachbericht 124, Mobile Kommunikation, Vorträge der ITG-Fachtagung vom 27. bis 29. September 1993 in Neu-Ulm (No 124, 27 Sept. - 29 Sept. 1993), page 483-501, "Intelligentes "Radio Resource Management "Mustererkennung mit GSM-Funkmessdate und Anwendung"	1,3-5,9
A		2,10,11
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Y	WO 9625830 A1 (EUROPOLITAN AB), 22 August 1996 (22.08.96), page 7, line 34 - page 9, line 13; page 15, line 1 - line 27; page 18, line 28 - page 19, line 25	2,4,11
A		3,9
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI 97/00596

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		NO 964877 A	15/11/96
		NO 973748 A	14/08/97
		SE 9500569 A	17/08/96
		SE 9502976 A	17/08/96
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		GB 9511843 D	00/00/00
		GB 9700581 D	00/00/00